storms were reported in the greatest number of states, 16, on the 12th and 13th; in 10 to 15 on the 1st to 6th, 11th, 12th, 16th, 18th, and 19th; and in 1 to 9 on the 7th, 8th, 9th, 15th, 17th, 20th to 27th, 29th, and 30th. The 28th and 31st were the only dates on which no thunder-storms were reported.

East of the Rocky Mountains thunder-storms were reported on the greatest number of dates, 16, in Iowa, and Mo.; on 10 to 15 in Ark., Fla., Ill., Kans., La., Mich., Ohio, and Tex.; and on 1 to 9 in Ala., Conn., Ga., Ind., Ind. T., Ky., Me., Md., Mass., Minn., Miss., Mont., Nebr., N. H., N. J., N. Y., N. C., N. Dak.. Pa., R. I., S. C., S. Dak., Tenn., Vt., Va., W. Va., and Wis. West of the Rocky Mountains thunder-storms were reported as follows: Ariz., 1st to 4th, and 10th; Colo., 1st, 11th, and 20th; Nev., 10th; N. Mex., 1st; Utah, 2d, 7th, and 11th; Wash., 16th; Wyo., 1st. No thunder-storms were reported in Cal., Del., D. C., Idaho, and Oregon.

INLAND NAVIGATION.

STAGE OF WATER IN RIVERS AND HARBORS.

The following table shows the danger-point at the several stations; the highest and lowest water during October, 1890, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, October, 1890 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
Red River.						
Shreveport, La	29.9	25, 26	7.3	13	5.5	1.8
Arkansas River.						
Fort Smith, Ark	22.0	25	11.2	6	4.2	7.0
Little Rock, Ark	23.0	27	12.4	8	7.8	4.6
Missouri River.						
Fort Buford, N. Dak	.....	10, 11	1.5	30, 31	0.4	1.1
Sioux City, Iowa	.....	2	4.5	20	3.6	0.9
Kansas City, Mo	21.0	16	4.5	30, 31	3.1	1.4
Mississippi River.						
Saint Paul, Minn	14.5	20 to 22	2.6	6	1.6	1.0
La Crosse, Wis	13.0	20	6.3	9, 10, 11	3.4	2.9
Dubuque, Iowa	16.0	25	7.6	10, 11	3.9	3.7
Davenport, Iowa	15.0	20 to 28	4.9	12, 13	2.3	2.6
Keokuk, Iowa	14.0	29, 30	4.8	14, 15	2.2	2.6
Saint Louis, Mo	32.0	22	9.4	17	6.7	2.7
Cairo, Ill	40.0	31	18.1	20	11.4	6.7
Memphis, Tenn	34.6	1	14.6	22	8.8	5.8
Vicksburg, Miss	41.0	2	22.9	26	13.0	9.9
New Orleans, La	13.0	6	6.4	28, 29	4.2	2.2
Ohio River.						
Pittsburgh, Pa	22.0	25	16.2	1	4.8	11.4
Parkersburgh, W. Va	38.0	27	23.2	4	6.9	16.3
Cincinnati, Ohio	50.0	30	32.9	1	12.0	20.9
Louisville, Ky	25.0	30	12.2	1, 2	6.3	5.9
Cumberland River.						
Nashville, Tenn	40.0	4	11.4	22	3.3	8.1
Tennessee River.						
Chattanooga, Tenn	33.0	27	9.5	16, 17, 18	3.7	5.8
Monongahela River.						
Pittsburgh, Pa	29.0	25	16.2	1	4.8	11.4

Heights of rivers—Continued.

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
Savannah River.						
Augusta, Ga	32.0	1	28.5	16	7.1	21.4
Willamette River.						
Portland, Oregon	15.0	2	2.7	8	0.2	2.5

FLOODS.

Reports of the 12th show that great damage was caused to crops, railroad, and other property in West Virginia by freshets in the Monongahela and Little Kanawha rivers and tributaries. At Glenville, W. Va., the Little Kanawha had risen 25 feet by the 13th, washing away large quantities of hay, corn, and lumber. At Parkersburgh, W. Va., the Ohio River rose 11 feet from the 13th to 15th, on which latter date it stood 21.1 feet on the gauge. The Connecticut River was unusually high on the 21st. The Roanoke River was rising rapidly at Weldon, N. C., on the 23d; on the 25th the water covered low ground; and on the 26th the water began to recede. A freshet was reported on the 26th in the Wyoming Valley, in the Susquehanna River basin, Pa. On the 29th high winds, together with a freshet, caused the Cape Fear River to flood its banks near Wilmington, N. C., inundating rice fields, sweeping away rice stacked in the fields, and flooding lower floors of stores on Water street in Wilmington. At Mossing Ford, Va., the excessive precipitation of the month caused the overflow of small streams.

MISCELLANEOUS PHENOMENA.

SUN SPOTS.

Haverford College Observatory, Pa., (observed by Prof. F. P. Leavenworth):

Date.	Number of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Faculæ.	Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	
Oct., 1890.										
1, 9 a. m.	0	0	0	0	0	0	1	28	0	Definition fair; spots small.
3, 11 a. m.	0	0	0	0	0	0	0	0	2	Definition fair.
4, 10 a. m.	1	2	0	0	0	0	1	2	5	Definition good.
5, 3 p. m.	1	12	0	0	0	0	2	14	2	Definition good; spots small.
8, 9 a. m.	0	0	0	0	0	0	1	1	2	Definition good; spots small.
10, 11 a. m.	1	1	0	0	0	0	1	1	2	Definition fair.
11, 10 a. m.	1	4	0	0	0	0	2	8	2	Definition fair.
14, 4 p. m.	0	0	0	0	0	0	1	2	1	Definition poor.
15, 10 a. m.	0	0	0	0	0	0	0	0	2	Definition poor.
17, 9 a. m.	0	0	0	0	0	0	0	0	2	Definition fair.
18, 10 a. m.	0	0	0	0	0	0	0	0	1	Definition good.
25, 10 a. m.	1	50	0	0	0	0	1	50	....	Definition partial through clouds.
26, 9 a. m.	0	0	0	0	0	0	1	40	1	Definition poor; large double spot.
27, 2 p. m.	0	0	0	0	0	0	1	24	0	Definition fair.
28, 9 a. m.	0	0	0	0	0	0	1	8	2	Definition poor.
29, 2 p. m.	0	0	0	0	0	0	1	16	3	Definition poor.
30, 10 a. m.	0	0	0	0	0	0	1	2	3	Definition fair.
31, 10 a. m.	0	0	0	1	0	0	1	4	3	Definition fair.

Mr. D. E. Hadden, Alta, Iowa: 1st, 1 group, 2 spots; small faculæ nw. 2d, faculæ on nw. limb. 6th, 1 group. 14th, faculæ near w. limb. 16th to 18th, clear disc. 19th, 1 group, 3 spots on se. limb, with faculæ. 20th, 1 group, 6 spots; 3 new spots, and group of faculæ on e. limb. 21st, 1 group, 6 spots, 3 spots large, with faculæ surrounding. 22d, 2 groups, 11 spots. 23d, 2 groups, 17 spots; 1 spot large, and the others small. 24th, 2 groups, 15 spots. 25th, 1 group, observation incomplete, clouds. 26th 1 group, 1 large spot; could not count spots, hazy. 30th, 1 group, 2 spots; faculæ in nw. 30th, 1 spot disappearing by rotation on w. limb; hazy. Cloudy on 3d, 5th, 8th, 13th, 15th, 27th to 29th.

Mr. John W. James, Riley, Ill.: 1st, one new group near west edge. 3d, no spots seen, but broad areas of faculæ on west limb. 7th to 17th, observations on 7 days but no spots seen. 19th, faculæ on east edge, followed on 20th by a fine large group, estimated 52,600 miles long, one large spot 26,300 miles diameter, and about 20 small spots. 24th, a new group southeast of large spot. 27th, all the small spots gone; faculæ in their place; the large spot, still intact, disappeared by solar rotation November 1st.

Mr. C. E. Buzzell, Leaf River, Ill.: 6th and 7th, small group in south latitude. 14th, small spot in south latitude near meridian. 19th, large group at east limb which completed the transit. Observations not taken on many dates on account of clouds.

Mr. H. D. Gowey, North Lewisburgh, Ohio: sun spots were observed on the 20th, 21st, and 24th.

DROUGHT.

At Minden, Nebr., the month was very dry; no fall plowing was done; and pastures were injured. At Howe, Nebr., no rain fell after the 15th, and wells were failing. Drought prevailed at Concordia, Kans.; many wells were dry and water was scarce. At Hannibal, Mo., no rain fell after the 15th; water for stock was scarce and wheat suffered by drought. At Pickering, Mo., the month was dry; streams were very low; water for stock scarce, and the ground too dry to plow. At Woonsocket, S. Dak., the drought continued during the month, and very little plowing was done. A report from Marshall, Minn., dated the 1st, stated that Island Lake, Goose Lake, and Lake Stay were dry.

PRAIRIE AND FOREST FIRES.

On the 2d extensive prairie fires were reported near New England City, N. Dak., and north and east of Bismarck, N. Dak. Prairie fires were reported south and west of Bismarck on the 4th. On the 9th prairie fires occurred at Cannon Ball, N. Dak. Destructive prairie fires were reported along the Cannon Ball, Knife, and Heart Rivers, N. Dak., during the first half of the month. Reports of the 21st from Los Angeles, Cal., state that extensive mountain fires prevailed near the Santa Monica Cañon, and grass fires on the plains, causing considerable damage. A report from San Diego, Cal., dated the 22d, states that brush fires prevailed, with hot, dry winds from the n. and nw., badly drying and burning raisin grapes. On the 2d timber fires had caused great damage near Rapid City, S. Dak.; several ranches were burned, and many telegraph poles were destroyed. On the 3d snow and rain nearly extinguished the fires. Destructive fires were also reported in the region of Rapid City on the 5th and 31st. Forest fires were reported near Red Bluff, Cal., on the 9th, 10th, 11th, 15th, and 25th to 31st.

VERIFICATIONS.

[Verifications made by Assistant Professor C. F. Marvin, assisted by Mr. H. E. Williams, chief clerk of the Forecast Division.]

FORECASTS FOR 24 HOURS IN ADVANCE.

The forecasts for districts east of the Rocky Mountains for October, 1890, were made by 2d Lieut. W. A. Glassford, Signal Corps, and those for the Pacific coast districts were made at San Francisco, Cal., by 2d Lieutenant John P. Finley, Signal Corps.

Percentages of forecasts verified, October, 1890.

States.		States.	
Maine	80.3	Kentucky	85.7
New Hampshire	73.2	Ohio	84.8
Vermont	75.0	West Virginia	86.4
Massachusetts	76.3	Indiana	82.6
Rhode Island	86.8	Illinois	81.0
Connecticut	82.1	Lower Michigan	78.9
Eastern New York	84.3	Upper Michigan	76.4
Western New York	84.1	Wisconsin	75.4
Eastern Pennsylvania	86.8	Minnesota	77.7
Western Pennsylvania	79.3	Iowa	75.2
New Jersey	87.1	Kansas	83.1
Delaware	84.3	Nebraska	86.3
Maryland	86.6	Missouri	77.7
District of Columbia	88.3	Colorado	83.0
Virginia	84.0	North Dakota	78.7
North Carolina	84.3	South Dakota	83.2
South Carolina	92.7	Southern California*	91.8
Georgia	92.8	Northern California*	87.8
Eastern Florida	90.6	Oregon*	83.2
Western Florida	92.1	Washington*	80.9
Alabama	91.4	*By elements:* Weather	88.5
Mississippi	91.0	Temperature†	77.1
Louisiana	90.8	Monthly percentage of weather and temperature combined‡	83.9
Texas	85.9		
Arkansas	85.9		
Tennessee	87.0		

*In determining the monthly percentage of weather and temperature combined, the Pacific coast states are not included. †The forecasts of temperature in districts east of the Rocky Mountains for October, 1890, were made with reference to the maximum temperature alone; that is, a prediction of warmer or cooler indicated that the maximum temperature of the day designated would be higher or lower than the maximum of the previous day. ‡The monthly percentage of weather and temperature combined is determined by multiplying the percentage of weather by 6, and the percentage of temperature by 4, and dividing their sum by 10.

FORECASTS FOR 48 HOURS IN ADVANCE.

Appreciating the great importance that long time predictions possess for the general public the Chief Signal Officer has authorized forecasts for 48 and 72 hours, covering the 2d and 3d days in advance. These are optional with the forecast official, and are only made when clearly in the public interest, and cover, in all cases, considerable areas of country, and are not confined to localities.

Percentages of verifications of forecasts made for second day in advance. Number of predictions made: weather, 11; temperature, 3. Percentages of verifications: weather, 60.0; temperature, 83.3; weather and temperature combined, 63.6.

No forecasts for 72 hours were made during the month.

CAUTIONARY SIGNALS FOR OCTOBER, 1890.

Statement showing percentages of justifications of wind signals for the month of October, 1890:

Wind signals.—(Ordered by 2d Lieut. W. A. Glassford). Total number of signals ordered, 121; justified as to velocity, wholly, 79, partly, 9; justified as to direction, 112. Of the signals ordered 88 were cautionary, of which 54 were wholly, and 6 partly justified; and 33 were storm signals, of which 25 were wholly, and 3 partly justified. 48 signals were ordered for easterly winds, of which 42 were justified, and 73 were ordered for westerly winds, of which 70 were justified. Percentage of justifications, 71.7.

No cold-wave signals were ordered during the month.

Percentages of verifications of weather and temperature signals reported by directors of the various State Weather Services for October, 1890.

States.	Weather.	Temperature.	States.	Weather.	Temperature.
Iowa	86	88	Nebraska	84	84
Illinois	75	71	New Jersey	83	88
Kansas	83	90	North and South Dakota	68	84
Michigan	82	87	Ohio	82	89
Minnesota	70	83	Pennsylvania	78	87
Missouri	79	84	South Carolina	80	90

STATE WEATHER SERVICES.

[*Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.*]

The following extracts and summaries are republished from reports for October, 1890, of the directors of the various state weather services:

ARKANSAS.

Temperature.—The mean was 1.7 below the normal; maximum, 91, at Lead Hill, 12th; minimum, 26, at Devall's Bluff and Stuttgart, 31st; greatest monthly range, 61, at Lead Hill; least monthly range, 32, at Malvern.

Precipitation.—The average was 1.00 above the normal of the last 8 years; greatest monthly, 4.46, at Camden; least monthly, 1.46, at Pine Bluff.—*M. F. Locke, Commissioner of Agriculture, Little Rock, director; F. H. Clarke, Sergeant, Signal Corps, assistant.*

ALABAMA.

Temperature.—The mean was 2.5 below the normal; maximum, 93, at